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RESEARCH REPORT

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Social Connections, Networks, and Social Capital Erosion: Evidence From Surveys and Field Experiments

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Measuring trust, a cognitive social capital that can significantly affect cooperation among individuals and groups to take collective actions for joint benefits, is an important empirical research. This EEPSEA study aimed to understand the determinants of social capital with specific focus on the effect of individuals' bonding social capital and bridging social capital. It explored the methods of measuring trust and identified the determining factors affecting trust/trustworthiness among village members in southwestern China's Yunnan province.

A survey was done on 600 farmers in 30 administrative villages. A trust game was conducted using the respondents as subjects of the experiments, 300 playing the role of senders and 300 playing the role of receivers. Results showed that education level could positively and significantly predict both players' behaviors. The percentage of expenditure on gift exchange in the sender's total family expenditure and trust measured were robust to the model's specifications and could almost predict the sender's behavior. Meanwhile, there was no significant evidence the surveyed trust could predict the receiver's behavior. The village's openness to the market and outside world also negatively and significantly predicted both players' behaviors. It showed that the receiver's family participation in closed versus opened networks had an opposite impact on receiver's behavior. Hence, social connection variables could play more important roles than individual demographic characteristics in interactions that involve social capital. However, social capital could be eroded when the villages become more open to the outside world and when informal institutions are gradually substituted by modern formal institutions.

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Abstract

Measuring trust, a cognitive social capital that can significantly affect cooperation among individuals and groups to take collective actions for joint benefits, is an important empirical research. This paper explored the methods of measuring trust and identified the determining factors affecting trust/trustworthiness among village members in southwestern China's Yunnan Province. To gather information, we surveyed 600 farmers in 30 administrative villages, conducted focus group discussions, and administered an experiment (e.g., trust game) among respondents in six counties. We also conducted trust games using the 600 respondents as subjects of the experiments, 300 playing the role of senders and 300 playing the role of receivers in a trust game.

Results showed that education level could positively and significantly predict both players' (Player 1 was sender and Player 2 was receiver) behaviors. Moreover, percentage of expenditure on gift exchange in Player 1's total family expenditure and trust measured by the survey method were robust to the model's specifications and could significantly predict the sender's behavior in the trust game. Meanwhile, there was no significant evidence that the trust could predict the receiver's behavior. The village's openness to the market and outside world also negatively and significantly predicted both players' behaviors. Further, the receiver's family participation in closed vs. open networks had an opposite impact on the receiver's behavior in the trust game. Hence, social connection variables could play more important roles than individual demographic characteristics in interactions that involve social capital. However, social capital could be eroded when the villages become more open to the outside world and when informal institutions are gradually substituted by modern formal institutions. Overall, with careful study designs, the survey and field experimental methods could complement each other in measuring trust and trustworthiness.

Key words: Social capital, trust, trustworthiness, networks

1. Introduction

Social capital plays important roles in resource management (Ostrom, 1990; Pretty and Ward, 2001; Baland, Platteau, 2002), public goods provision (Edward and Gugerty, 2005), and adaptation to climate change (Adger, 2003). Social capital within rural communities provides a sustainable solution for sustaining livelihood and managing resources – two processes that often involve the collective actions of rural communities (Pretty and Ward, 2001). Further, social capital is often an important substitute for formal institutions in facilitating collective actions among resource users (Ostrom, 1992) through its roles in mutual monitoring; maintaining the credibility of social sanction; providing common knowledge of the trustworthiness of peer members; and facilitating information-sharing and coordination (Sobel, 2002; Grootaert, 1998; Besley et al., 1993).

Social capital has been found to play important roles in the project design and implementation of the world's first Clean Development Mechanism (CDM) forest project implemented in China for global climate change mitigation (Gong et al., 2009). When contracts signed among partners have 'uncertainties' about the other party being opportunistic, trust, which is an integral part of social capital, can lubricate cooperation (Pretty and Ward, 2001) and play other particularly important roles.

However, in spite of its important roles, the determinants of social capital are still not clearly known. One challenge faced by empirical researches on social capital is related to the determinants of trust, a subjective matter belonging to the category of cognitive social capital, which is related to norms, values, attitudes and beliefs (Uploff, 2000).

This empirical paper aimed to understand the determinants of social capital with specific focus on the effect of individuals' bonding social capital and bridging social capital. The research design was inspired by the research of Croson and Buchan (1999), Glaeser and Laibson (2000), Barr (2003), Karlan (2005), and Schechter (2007). It combined field experiments and surveys to measure trust and analyze the determinants of trust/trustworthiness among people in rural community settings where members have real interactions in their daily lives.

Trust games and household surveys were conducted in 30 villages in the rural Yunnan Province of Southwestern China. Results of the trust games were used to measure the outcomes of the individuals' social capital. The individuals' bonding and bridging social capital were measured by: (1] their social connections in their villages, (2) their participation in different types of social networks, (3) their stated trust/trustworthiness, and (4) the openness of the surveyed village to the market. All the above measurements were used as major variables in econometric models to analyze their effect on the "outcomes" from the trust games.

Major results showed the following: [1] individuals' participation in family-based close networks and village-wide modern social networks had opposite impact on the outcomes of their social capital. This indicates that more interactions underlying the village-wide modern networks could contribute to higher outcomes of social capital, while the close-knit network has negative impact on the outcomes of social capital;

[2] the individuals' stated trust could positively and significantly determine the outcomes of trust, implying that with proper design, the stated trust could largely measure the revealed trust; and [3] the village's level of openness to the outside market seemed to erode the trust among village members.

This paper makes a major contribution to providing concrete empirical evidence on the impact of different types of social networks, human capital, and level of mutual trust on the outcomes of social capital. Findings also have important policy implications. First, a good understanding of the types of existing social networks and levels of mutual trust among village members is needed for successful policy interventions or project implementation that requires the cooperation of individual members. Second, given the significant prediction power of the stated trust on the revealed trust in the trust games, a properly designed survey can be a viable tool in obtaining information on mutual trust among community members. Third, given the importance of social capital in sustainable development and resource management, open social networks can be strengthened to increase interactions among community members. Fourth, given the positive and significant effect of education on the outcomes of social capital, the human social capital in the local area should be enhanced.

The paper is organized as follows: section II briefly reviews the standard trust game design and some extensions; section III describes the survey and experimental design of the study; section IV covers the results and discussions; and section V gives the conclusions.

2. Standard Trust Game and Some Previous Extensions

The trust game was originated by Berg-Dickhaut-McCabe (hereafter referred to as BERG-DICKHAUT-MCCABE) (Berg, Dickhaut, and McCabe, 1995). The standard Berg-Dickhaut-McCabe trust game is played between two players, Player A and Player B, and the game is facilitated by administrators. The game is played under double-blind conditions, i.e., the individual subject's decisions are unobservable to all parties involved.

The Berg-Dickhaut-McCabe game is a one-shot game. Player A plays the role of sender, who is given US$10 at the beginning of the game. Player A is anonymously matched with player B who plays the role of receiver. Player A makes decisions on whether or not to send Player B any money, and if ever, how much to send. Player B, on the other hand, makes decisions on the amount of money s/he will send back to Player A if s/he receives some amount. The information known to both players is as follows: [1] they are anonymous to each other; [2] the money sent by Player A will be tripled before it is sent to player B; [3] they could both choose to send/return or not send/not return the money.

The standard Berg-Dickhaut-McCabe trust game is thought to measure Player A's trust level and Player B's trustworthiness level based on the following justifications. Since the game is a one-shot game and Player B makes the decisions on whether or

not to send back some amount of money to Player A, s/he will choose to keep all money sent by player A if s/he is simply a pay-off maximizer. Believing that player B will not send any amount back, Player A may choose not to send any amount to player B in the first place. Under the mere assumption of pay-off maximization, the sub-game perfect Nash equilibrium of the game will be (0, 0), i.e., Player A sends nothing and Player B has nothing to send back. In contrast, if Player A believes that Player B will send back some amount, then Player A will tend to choose some amount of money, which will be tripled, and then sent to player B. Thinking that Player A will still decide to send some amount to Player B even though Player A knows that Player B could decide not to send anything back, Player B will be inclined to send some amount to Player B so that Player B can reciprocate Player A. Therefore, the amount that will be sent by Player A is used as the proxy to measure Player A's trusting level, while the amount of money that will be sent by Player B will be used to measure Player B's trustworthiness level. Indeed, the outcomes of the game conducted by Berg-Dickhaut-McCabe were inconsistent with the sub-game perfect Nash equilibrium (0, 0) that is predicted based simply on the assumption of maximizing money payoff.

Various researchers have modified the standard Berg-Dickhaut-McCabe game. Glaeser and Laibson (2000) made the paired players known to each other to analyze the impact of the players' social-connectedness on their behaviors in the game; they doubled instead of tripled the amount sent by Player A to reduce the players' incentives to cooperate; and they combined survey questions with the trust game to measure the trust and trustworthiness of the subjects they recruited from the undergraduate students. Burks et al. (2003) allowed the players to play both roles, i.e., sender and the receiver, and they found that playing both roles reduced the trust and trustworthiness in the game. Schechter (2007) allowed the subjects from rural villages in Paraguay, who had varying levels of education, to play both sender and receiver roles, and to know who the administrator was so that the villagers would understood the game they were playing. In rural Peru among members of a village banking organization in the local area, Karlan (2005) had the players play the game face-to-face, with similar amounts of money at the beginning of the game, and in the presence of administrators. Karlan (2005) and Schechter (2007), in their experiments conducted in rural settings, found that the experimenters were crucial for each player to understand the game, but they could also influence the players.

3. Survey and Experimental Design

Questionnaire surveys and trust games were conducted in each randomly selected village in rural Yunnan Province of Southwest China. A total of 30 administrative villages from five counties in Yunnan were chosen. In each village, two natural villages (the sub-unit of the administrative villages) were randomly chosen. In each natural village, 10 respondents were randomly chosen. In total, there were 600 respondents surveyed.

Subjects for the trust games were the respondents of the surveys. For the trust game, the two natural villages selected from the same administrative village were randomly divided into two groups: 10 subjects from one natural village playing the role of senders (*hereafter referred to as Player 1*) and 10 subjects from another natural village playing the role of receivers (*hereafter referred to as Player 2*). As a result, 300 subjects from 30 natural villages played the role of senders and 300 subjects from 30 natural villages played the role of receivers.

3.1 Survey Design

The surveys were conducted before the trust games for the respondents to gradually get comfortable with the enumerators, who were also the experimenters of the game. The surveys used structured questionnaires to ask the respondents' socio-economic, demographic, and land use decisions. The surveys included a specific section on the social capital, including the attitudinal questions on the trust, mutual help, and equalities among the village members. The respondents were asked to give ranks to the questions raised to them (with 1 indicating "strongly disagree" and 5 "strongly agree). Regarding questions on trust, questions were asked on the subjects' opinion on the trust and trustworthiness of their peer members in their own villages rather than on the trust and trustworthiness of the general public, including strangers.

Four questions related to trust/trustworthiness and other aspects related to social relationships were asked.

1) For the trust questions, they were asked to rank the following statements:

[1] Your village members are trustworthy.
[2] When you are away, you will ask your neighbor to look after your house.
[3] You will only lend money to good friends or relatives in your village.

2) For the level of mutual help questions, they were presented the following statements and asked to give Yes or No answers:

When your village faces external shocks such as bad crops in a certain year, how will you go through the difficulties?
[1] Friends in the same village will help you.
[2] Neighbors will help you.
[3] All village members will help you.
[4] Relatives outside the village will help you.
[5] Village leaders will help all village members overcome the difficulties.
[6] You can only rely on the government to help your village.

3) For the equality level among village members, the respondents were presented the following statements and asked to give Yes (=1) or No (=0) answers.

[1] There is no difference between the educated and poorly educated.
[2] There is no difference between the rich and the poor.
[3] There is no difference between the village leaders and village members.

[4] There is no difference between prominent and ordinary family names.
[5] There is no difference between those who were born in the village and those who immigrated to the village.

4) For the village leaders' helpfulness in conflict resolutions, they were asked to rank the following statement.

When conflicts arise among village members, the village leaders will help resolve the conflicts.

3.2 Experimental Design

After the surveys, the respondents were also asked to play the trust game. Twenty respondents were randomly assigned into two groups, i.e., 10 playing the role of senders and another 10 playing the role of receivers. Each survey enumerator also served as the experimenter of the game. S/he explained all the rules to the players and made sure that the players understood the association between the decisions they would make and the final payoffs they and their partners would get after the game.

The trust game was adapted from Schechter (2007) with two major modifications.

The first modification was that the players in the trust game only played a single role – that of the sender or the receiver, while Schechter's players played both roles. Nonetheless, there is still debate on whether playing both roles could complicate the situation.

The second modification was that the players involved in the game were not called to the same place to participate in the game. Rather, the experimenters went to conduct individual sessions with the selected subjects. This was done to ensure that the players did not meet each other, hence ensuring their anonymity from each other. As mentioned earlier, two natural villages were randomly chosen from each administrative village. In the morning, 10 experimenters simultaneously conducted experiments for Players 1 in one natural village. In the afternoon, they simultaneously conducted experiments for Players 2 in another natural village. Since the natural villages were located far from each other in rural Yunnan, finishing experiments within one day in two different natural villages helped keep the anonymity between the senders and receivers.

The reason for the anonymous pairing was to ease the players' worries about any post-game consequences (e.g., sanctions by one party, or emotions about any decisions made during the game). It must be noted that all the players in a certain session of the trust game were from the same village, and their decisions would inevitably have impacts on their feelings and interactions after the games. If the players knew each other's identities, then their concern for any post-game consequences could possibly affect their decisions-making in the game.

The trust games followed these steps:

Step 1: At the beginning of the game, all participants were given RMB 20 as payment for their time commitment to answer the survey questions and for their

participation in the games. This implied that the RMB 20 yuan was the money at their own disposal.

Step 2: After the rules of the games were given, the senders were given five choices as to whom to send various amounts of money: RMB 0 yuan, RMB 5 yuan, RMB 10 yuan, RMB 15 yuan, and RMB 20 yuan.

Step 3: If the senders chose not to send any money, then the game was over; if the senders chose to send some amount, the experimenter doubled the amount. The experimenter placed the amount in an envelope in front of the senders, and the senders gave the said amount to the receivers. For the senders who decided to send some amount, they were asked to guess the most possible amount of money sent by the receivers to them. The experimenter then left the senders.

Step 4: After the rules of the game were given, the receivers were asked first to guess the most possible amount of money they would receive from the senders. This question was asked even for receivers paired with senders who decided not to send any money. After the receivers made guesses, the experimenter opened the envelope that contained the doubled amount of money sent by the senders.

Step 5: The receivers then decided not to send back any money, to send a certain amount, or to send all the money (already double the amount originally sent by the senders) to the senders. The receivers did not need to send back the initial RMB 20 given by the experimenter. If the receivers sent nothing back, the game was over; if the receivers decided to send some amount back, the experimenter sent back the money to the senders.

The following were worth noting during the trust game:

[1] The trust games in this research were used to measure the village members' trust on and trustworthiness among their peer members from the same village rather than their trust on the general public. Therefore, the following common information were provided to every player:

(a) All paired players in the game were randomly selected from their own villages, which meant that anybody from their village could be picked up and paired together;

(b) The sender could not know who was paired with him/her, neither could the receiver, but it was certain that the paired ones were from the SAME village.

[2] Both the sender and the receiver were given RMB 20 yuan to control for the effect of the "fairness" consideration of Player 1 in making his/her decision. The sender and the receiver knew that BOTH of them had RMB 20 yuan at the beginning of the game, and that if the sender decided to send nothing, both of them could get RMB 20 yuan at the end of the game.

Given this set-up, we hoped to ease the effect of "fairness" on Player 1 in making his/her decision. Suppose only RMB 20 yuan had been given to Player 1, then Player 2 would think that the former would have nothing if s/he did not send any amount to

the Player 2. Therefore, Player 1 may have chosen to send "some" amount, wanting to be "fair" to the fellow villager paired with him/her.

[3] We tried to control for the possible effect of Player 1's concern for the "risk" of the "investment mechanism" in decision-making. The sender (Player 1) involved in the traditional trust game basically knew that s/he was involved in investment settings. Although the traditional trust game implicitly gave information that the "investment" had no "risk", s/he (Player 1) might unconsciously confound the "riskiness of the investment" in his/her decision-making. Therefore, we used an elicitation mechanism that stressed the "no risk of the investment" information to make the game more tangible to the players and to minimize the possible impact of Player 1's concern for 'risk of the investment' in making his/her decisions. The elicitation process was as follows:

There was a project, which had a 100% certainty of generating profit. However, the project was going to be implemented by the receiver. The receiver was required to deposit RMB 20 yuan, which was paid by the experimenter, as a prerequisite for him to implement the project. S/he could only make profit if s/he could get additional amount from his/her paired member, the sender; the more s/he got from the sender, the more profit s/he could earn.

For example, if the sender decided to send RMB 5 yuan to the paired receiver, the experimenter would double this amount and send RMB 10 yuan to the receiver, then the receiver would have RMB 10 to divide between the two of them. If the sender decided to send RMB 20 yuan to the paired receiver, the experimenter would double this amount and send RMB 40 yuan to the receiver, then the receiver would have RMB 40 to divide between the two of them. If the sender decided to send nothing to the paired receiver, the experimenter would have nothing to send to the receiver, then the receiver would have nothing to divide between the two of them; nonetheless, both the sender and the receiver would still have RMB 20 for each of them.

[4] We chose RMB 20 yuan, which was equivalent to the daily wage in the local area, as the stake for the trust game based on the observations in the pretest experiments. In the pretest experiments, the players were provided RMB 5 yuan or RMB 10 yuan. It was noticed that some senders made very quick decisions by sending all the RMB 5 yuan. Even though the experimenter reminded them that it was money at their disposal, they said that they did not really feel hurt if they sent out RMB 5 yuan and did not get it back because RMB 5 was relatively a small amount of money. After several pretest rounds, we decided to use RMB20 yuan.

[5] Throughout the game, the experimenters used the words of "send to" and "send back" instead of "lending" or "borrowing" to keep the experiments value-free, hence separated from daily practices and moral issues.

[6] The experimenters guided the players through some examples by means of tokens to calculate their own payoffs and their partners' payoffs associated with decisions made in the game:

$$\text{Payoffs to Player 1} = 20-x+y \quad (1)$$

$$\text{Payoffs to Player 2} = 20+2x-y \quad (2)$$

where: x is the amount sent by Player 1 to Player 2, while y is the amount sent back by Player 2 to Player 1.

Once the players understood the rudiments of the game and have practiced using the examples, the games were formally played.

4. Data Analysis

In the standard analysis for the trust game, the amount sent by Player 1 to Player 2 was used to measure Player 1's trust level and Player 2's return ratio. The return ratio was the ratio of the amount returned by Player 2 to the total amount received by Player 2, and this was used to measure Player 2's trustworthiness. Given the set-up of our trust game, the total amount received by Player 2 was double the amount sent by Player 1.

Two separate regressions were run for Player 1's equation and Player 2's equation. We included four indices: trust index, mutual help index, equality index, and village leaders' index in the regressions in both regressions. The four indices were created from the questions in the surveys about (1) the player's perceptions on his/her trust towards the village members and the village members' trustworthiness, (2) the help that his/her family could get in the face of difficulties, (3) the equality level among village members, and (4) the village leaders' helpfulness in conflict resolutions.

For example, for the trust index, we first demeaned and normalized the relevant scales (ranks) given by respondents on each of the three trust questions. The same method was used to create the mutual help index and inequality index. We also included Player 1's self-reported risk attribute and frequencies of gambling per month in his/her regression to control for the possible effect of the his/her risk preference in his/her decision. Trust often implies relational risk and trusting behaviors have been found to be confounded with this risk (Schechter, 2007).

For Player 1's equation, the interval regression model was used to examine whether trust measured by the survey questions, his/her demographic, characteristics, social relationship, and characteristics of his/her village could predict the amount s/he would send.

For Player 2's equation, we first ran OLS regression to analyze whether the amount sent by the sender, his/her demographic and social relationship variables, and his/her village's characteristics could significantly predict his/her return ratio, based on the consideration that his/her choices were continuous between 0 and the double amount of money sent by Player 1.

We also noticed that the return ratio of 0.5 and 0.75 had high frequency of data points in Player 2's data set, so we opted to create a dummy variable for the return ratio: 0 for the return ratio equal to and less than 0.5; and 1 for the return ratio greater than 0.5. We tried the logit model for Player 2's equation and found that this model

specification could significantly explain his/her data. We tried the probit model as well and found the same significance level in the coefficients, but the resulting information criteria (AIC and BIC) showed that the logit model performed slightly better than the probit model. Therefore, we used the logit model for the final regression for Player 2. The logit model is specified as follows:

$$\mathrm{logit}(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_{1,i} + \ldots + \beta_1 x_{k,i} + \varepsilon_i$$

where: p_i is the probability of the event occurring and the probability density function follows a logistic distribution.

In our model, we defined 1= Player 2 returned more than 50% of the amount received; 0 was otherwise.

5. Results and Discussion

5.1 Summary of Outcomes of the Trust Games

Outcomes of our trust game were consistent with the results from previous trust games and inconsistent with the sub-game perfect Nash equilibrium predicted based on the individual payoff maximization, i.e., Player 1 would send 0 and Player 2 would return 0.

Overall, 229 (77%) of Player 1 sent a certain amount of money to Player 2, and 222 (97%) of Player 2, who received some amount of money from Player 1, also decided to return some amount back to Player 1 (Table 1).

Table 1. Summary statistics of the outcomes from the trust game

Variables	Mean	Std. Dev.	Range	Obs.
Average amount sent by the Player 1	8.38	6.39	0-20	298
Player 1's ratio of amount sent	42%	32%	0-1	298
Average amount returned by Player 2	10.00	8.68	0-35	298
Player 2's return ratio	59%	19%	0-1	228

On average, Player 1 sent RMB 8.38 yuan, about 42% of the maximum amount that could be sent (RMB20), with a standard deviation of RMB6.39. Player 2 returned an average amount of RMB 10 yuan with a standard deviation of RMB 8.66 yuan. On the average, the amount returned by Player 2 was about 19% higher than the average amount sent by Player 1. As a result of trusting behavior, the average payoffs were RMB 21.63 yuan for Player 1 and RMB 26.75 yuan for Player 2, as compared to RMB 20 yuan for both players in a non-trusting case. Therefore, trust leads to the welfare improvement of the players as opposed to non-trusting cases.

The results of our trust game indicated a strong positive correlation between the amount sent by Player 1 and the amount returned Player 2 as plotted in Figure 1.

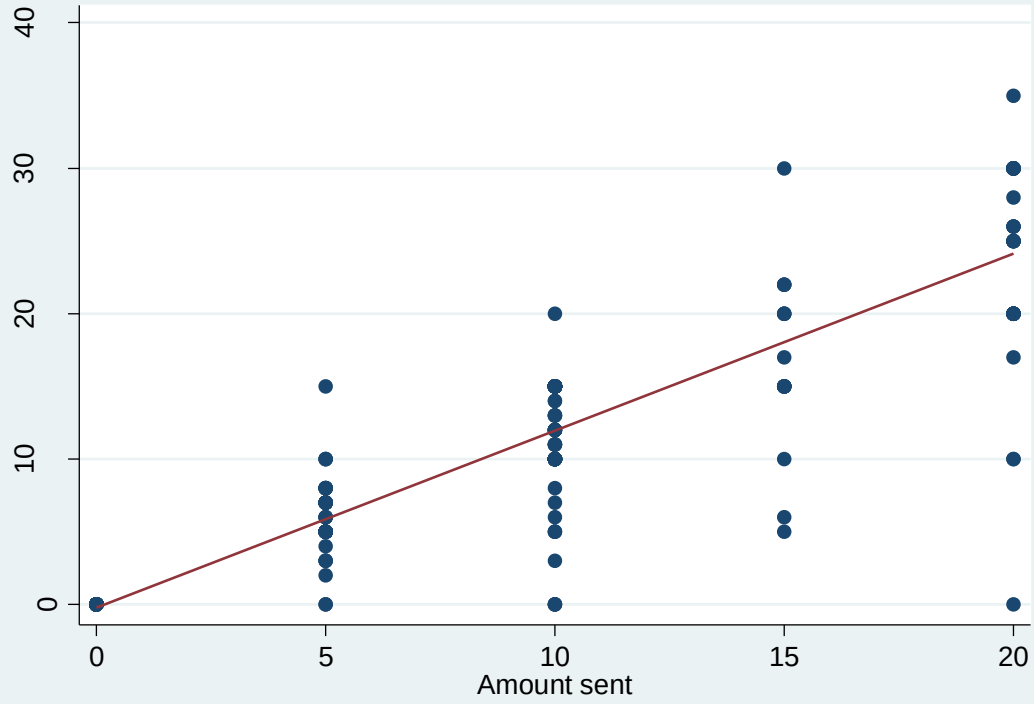

Fig. 1 Relationship Between Amount Sent and Amount Returned

Figure 1 shows the "co-movement" of the amount sent and the amount returned, i.e. the higher amount sent by Player 1, the higher average amount returned by Player 2. This result indicated a high correlation (0.8964) between the amount sent and the amount returned.

Figure 2 plots the distribution of amount sent by Player 1 and the return ratio of Player 2.

Figure 2 shows that there was heterogeneity in the amount sent by Player 1 and Player 2's return ratio. About 23% (69 members) of Player 1 decided not to send anything, slightly less than 40% (114 members) sent RMB 10 yuan, and about 20% (59 members) sent either RMB 15 yuan or RMB 20 yuan. Although the return ratio for Player 2 was distributed within the range of [0 1], over one-third (77 members) of them chose to return 50% of the amount they received and about 27% (61 members) decided to return 75% of the received amount. Overall, about 45% of Player 2 decided to return half of or less than half of the amount they received, while about 55% of Player 2 chose to return more than half of the amount received.

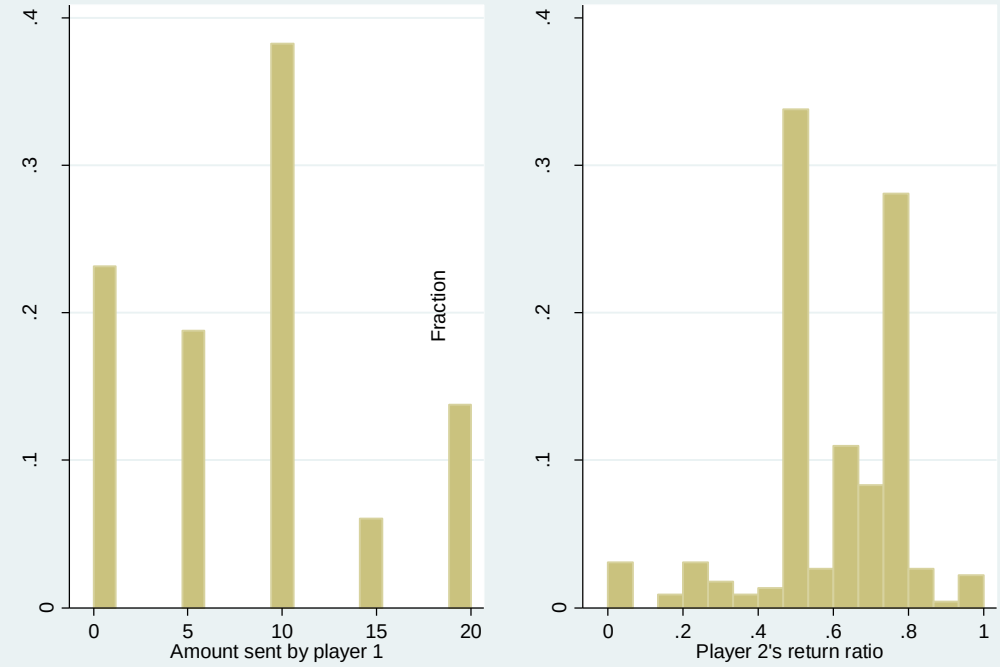

Fig. 2 Distribution of Amount Sent and Return Ratio

5.2 The Village and Players' Characteristics

The villages were quite heterogeneous in terms of their economic conditions and geographic remoteness (Table 2).

Table 2. Characteristics of the surveyed villages

Variables	Mean	Std. Dev.	# of Obs.
Number of natural villages	9	7	30
Total number of households in the village	534	247	30
Annual income per capita (US$)	220	118	30
Village with access to electricity	90%	30%	30
Proportion of households with phones	58%	25%	30
Distance to the county's capital township (km)	40.6	23.2	30
Distance to the nearest financial institutions (km)	9.4	11.1	30

The three main variables to measure the villages' geographic remoteness and their openness to the market included: (1) the distance to the nearest financial institutions, which in the Chinese context, are often located in the local market place; (2) the distance to the capital townships of the counties; (3) and the proportion of the households with phones. The average distance between the surveyed villages and the local market place was about 9 km with some villages located as far as 44 km away. On the average, about 58% of the households either had cell phones or landline or both.

Table 3 summarizes information on the players' demographic profile and social relationships.

Table 3. Summary of the players' demographic profile and social relationships

Variables	Mean	Std. Dev.	Obs.
Players' individual and household characteristics			
Household size	5	2	596
Family total income in 2006 (US$)	912.74	2437.83	596
Education level	6	4	596
Male	92%	28%	596
Age	46	12	596
Players' social relationships and interactions			
Proportion of expenditure on gift exchanges in total HH expenditure	12%	11%	599
The household head was a village leader in 2006.	6%	23%	596
The household head was born in the village.	90%	30%	596
The family belongs to a large ethnic group.	92%	28%	596
The family belongs to a prominent family.	48%	50%	596
The family attended ceremonies in their ancestral halls.	21%	40%	596
The household was involved in certain types of modern networks in 2006	41%	49%	596

Table 3 shows that the players had an average education level of six years. However, further analysis showed that only 25% of the players had finished secondary school education, and about 10% were illiterate. The players' families spent, on the average, 12% of their total family expenditures on gift exchanges.

About 21% of the players' families attended ceremonies in their families' ancestral halls. Almost half (41%) of the players' families were also involved in certain types of village-wide associations, such as sports association, women's association, and trading associations. Since families' ancestral halls were only accessible to very limited group members, such as members sharing the same family names, this kind of network can be categorized as "traditional" networks. Meanwhile, village-wide associations can be categorized as "modern" networks.

We found a negative correlation between participation in "traditional" and "modern" networks, indicating that families who were more involved in "traditional" networks tended to participate less in "modern" networks. In rural China, only those families with prominent family names in their villages usually have ancestral halls, thus they are the who ones attended ceremonies in these halls. Indeed, there was a positive correlation coefficient between the player's participation in ceremonies held in families' ancestral halls and the dummy variable of family name's prominence in the village.

5.3 Predicting the Amount of Money Sent

We ran three different regression models to identify the determining factors that could significantly predict the variations in amount of money sent by Player 1 and to

check whether or not some significant determining factors would be robust to different model specifications. For all three models, we included the county dummies to control for some unobserved fixed effect across the counties. First, we tried to identify if Player 1's demographic characteristics, social relationships, and village characteristics could predict the amount of money sent in the trust game (*Model 1*). Second, we tried to examine whether or not trust/trustworthiness and other related social capital variables measured by the survey questions could significantly predict the amount of money sent by controlling for Player 1's demographic characteristics and social relationships (*Model 2*). Third, we considered that the trusting behaviors could be confounded with the player's risk preferences as discussed by Schechter (2007).

We speculated that players with different frequency of monthly gambling could have different risk behaviors. Therefore, in model 3 we included two variables related to the players' risk preference: the players' self-reported risk preference (1= risk-loving, 0=otherwise) and the number of gambling activities they engage in a month Since the risk attitudes and gambling activities were asked of Player 1 during the survey before the trust game, we could assume that his/her trusting behavior would not negatively affect his/her answers to the risk questions.

Regarding the village's characteristics, we included only the proportion of the households having telephones as a key village-level variable in the final regressions. Having telephones in the villages was found to be a better variable to measure the openness of a certain village to the market or outside world based on the model specification test and past researches. For instance, the variables - distance of the village to the nearest credit center and to the county's capital township - were not significant in predicting the test specification model. Moreover, the distance of the village and the telephone rate were negatively correlated, showing that the farther the village from the county's capital town or the nearest credit center, the lower the proportion of households having telephones in the village. Moreover, other relevant village characteristics, such as the size of village and income per capita in the village in 2006 were tested to be insignificant in predicting the models.

Table 4 presents the independent variables included in the three regressions and results of the analysis. The independent variables in the three regressions were selected by using model specification tests, such as LR test statistics and information criteria.

In all the three models, Player 1's education level; percentage of gift expenditure in the family's total expenditure; proportion of households with telephones in the village where s/he lived; and the percent of expenditure on gift exchange in the family's total expenditure were all significant in predicting Player 1's decisions in the trust game, and they were robust to the model specifications.

Across all three models, educational level positively and significantly predicted Player 1's behaviors at 1% significance level. Better educated players could possibly better connect positively the amount s/he sent and the joint profit that would be divided between him/her and Player 2.

Table 4. Predicting trusting behaviors for the sender (Player 1)

	(Interval regression)					
	(1)		*(2)*		*(3)*	
Education level	0.209	(0.077)**	0.189	(0.075)**	0.184	(0.076)**
Age	0.036	(0.137)	0.060	(0.139)	0.041	(0.137)
Age-squared	9.33e-05	(0.001)	0.000	(0.001)	4.67e-05	(0.001)
Male	0.827	(0.346)	0.799	(0.992)	0.804	(1.150)
Family head born in the village	1.238	(0.689)*	0.872	(0.702)	1.031	(0.753)
Percentage of gift expenditure	0.064	(0.020)***	0.060	(0.007)***	0.061	(0.024)***
Family's total income	-2.18e-06	(1.19e-05)	-2.30e-06	(1.06e-05)	-3.24e-06	(1.29e-05)
Participation in networks	0.250	(0.516)	0.351	(0.489)	0.386	(0.508)
Participation in ceremonies in the ancestral hall	-0.292	(0.317)	-0.289	(0.316)	-0.417	(0.311)
Help index	-		0.045	(0.097)	0.032	(0.084)
Trust index	-		0.324	(0.108)***	0.339	(0.109)***
Village leader's resolution index	-		-0.036	(0.248)	-0.111	(0.235)
Equality index	-		-0.030	(0.069)	-0.041	(0.065)
Self-reported risk attitude	-		-		0.887	(0.471)*
Time of monthly gambling	-		-		0.042	(0.043)
Proportion of households with telephones in the village	-2.191	(1.063)*	-2.007	(1.049)*	-1.970	(1.048)*
Jianchuan County	0.346	(0.828)	0.172	(0.796)	0.213	(0.768)
Jingu County	2.167	(0.750)***	2.246	(0.736)***	2.120	(0.792)***
Luxi County	0.237	(0.849)	-0.061	(0.829)	-0.018	(0.860)
Pingbian County	-1.203	(0.987)	-1.251	(0.984)	-1.228	(0.927)
Yongping County	0.034	(0.889)	-0.261	(0.905)	-0.265	(0.891)
Intercept	6.008	(3.550)	6.033	(3.650)	5.941	(3.703)
lnsigma	1.252	(0.028)	1.232	(0.028)	1.221	(0.043)
sigma	3.497	(0.096)	3.427	(0.098)	3.392	(0.148)
Log pseudo likelihood	-516.318		-511.176		-508.396	
Observations	292		292		292	

Note: Robust standard errors in parentheses. The base county is E'shan County. ***—coefficient significant at 0.01 level, **—coefficient significant at 0.05 level, *—coefficient significant at 0.1 level.

The higher proportion of expenditure on gift exchange in the family's total expenditure positively and significantly predicted Player 1's trusting behavior at 5% across all three models. In rural China, gifts were often exchanged between relatives and village members who enjoyed good relationships. Hence the level of gift exchange indicated a family's social connections in the village. Higher proportions of gift exchange expenditures were often involved as the players' families had more interactions with others. Player 1, whose family had more interactions with village members, had a higher prior probability that the money s/he sent might go to one of his/her relatives or friends. In addition, the higher expenditure on gift exchange also reflected Player 1's bonds to his/her peer members, causing him/her to trust them more and believe more that others would reciprocate this trust.

The proportion of households having telephones in a village was significantly but negatively correlated in predicting Player 1's trusting behavior. This indicated that if Player 1 came from villages with more households having telephone lines, s/he was less likely to send more money to Player 2 than from villages having less telephone lines. Since this variable can measure the openness of a certain village, the negative

sign meant that people from closed communities had a higher level of trust. Probably, members in closed communities tend to rely on each other more and engage in more interactions, thus they trust each other more.

Trust index created from the survey questions was found to be positively significant in predicting Player 1's trusting behavior, and the significance was robust to the model's specifications. This implies that the respondent's attitudinal characteristics to the trust questions affected his/her decisions. The higher his/her trust on the village members, the greater the possibility that s/he would send some amount of money. Our findings were consistent with the results of Glaeser et al. (2000) that the 'trusting' variables could significantly predict the sender's trusting behaviors in the trust game. This shows that with careful design, the survey and experimental methods could be used to measure trust.

Self-reported risk attitude positively and significantly predicted Player 1's behavior in the trust game, while the frequency of monthly gambling had insignificant but positive effect on Player 1's probabilities of sending a higher amount of money. If the person reported that s/he was a risk-loving person, s/he was found to send significantly more money in the trust game. If a person had higher frequency of gambling, s/he tended to send more money as well. This implied that there could be some positive correlation between trusting behavior and the player's risk preference.

Our regressions show that participation in "traditional" closed vs. "modern" open networks had opposite signs on Player 1's probability of sending higher amount of money in the trust game. However, both variables were not significant in predicting Player 1's trusting behaviors in all three regression models. A participant in 'traditional' networks sent less money to his/her village members than someone, who was not; while a participant in village-wide 'modern' networks sent more money than someone who was not. If trusting behavior can be seen as a signal of Player 1's cooperative behavior, the regression analysis showed that a person who participated in very closely-knit 'traditional' networks seemed to be less cooperative, in contrast to a person who was involved in village-wide open networks.

Not surprisingly, the help index positively predicted Player 1's trusting behavior. The village leaders' helpfulness in conflict resolutions and the inequality index negatively affected Player 1's probabilities of sending more money in the trust game. None of the above three indices, however, significantly predicted Player 1's trusting behavior. This shows that when a person could get more help and s/he lived in a village, when s/he viewed village members as being relatively equal regardless of economic conditions and social status, and when village leaders could resolve conflicts among villagers, s/he tended to send more money than a person who lived otherwise.

Age was not significant in predicting Player 1's behavior. However, the older villagers seemed to trust their village members more than the young people did, while the middle-aged villagers (between 35 and 50 years old) seemed to trust their village members less than the younger ones aged below 35 years did.

Jinggu County was significant in predicting Player 1's behavior probably because of some observed county-specific characteristics. Given the current data set, we cannot make any further judgment on why Player 1 from this county tended to send

significantly more money than those coming from E'shan County, the base county in the regressions.

5.4 Predicting Player 2's Return Ratio

We ran two regression models to identify the determining factors that could explain the variations in Player 2's return ratios. Model 1 aimed to identify whether or not Player 2's demographic characteristics and social relationships, as well as the characteristics of his/her village, could significantly predict his/her behaviors in the trust game. Model 2 included perceptional variables regarding Player 2's trust on his/her peer members and on his/her peer members' trustworthiness, the equality status of the village members, and the village leaders' capability of resolving conflicts among the villagers. The model tried to identify whether or not these perceptional variables could predict Player 2's behavior in the trust game.

Basically, we included almost the same set of covariates in Player 2's models as those used in Player 1's regression models based on the model specification test. We also included the amount of money sent by Player 1 as an independent variable in Player 2's regression model considering the strong positive correlation between the amount of money sent and the amount returned in our trust game (Fig. 1). We specified the model as a logit model rather than an OLS regression model for the reasons discussed earlier. Table 5 presents the results for the two regression models.

As expected, we found that the amount sent by Player 1 was positively and significantly correlated with the probabilities that Player 2 would return more than half of the received money in both models. This implies that the players were trustworthy and kind/reciprocal to each other. The significance of the amount sent by the Player 1 was robust to the specifications of the two models.

Education level significantly and positively predicted Player 2's behavior in both models. Player 2 with higher education level would most significantly and likely return over 50% of the amount s/he received.

We found that certain social relationship variables significantly predicted Player 2's behavior, and these were robust to specifications of the two different models. These were [1] if the head of Player 2's family was born in the village, it was significantly less likely that s/he would return more than 50% of the money s/he received; [2] if Player 2's family was involved in village-wide "modern" associations, it was significantly more likely that s/he would return more than 50% of the money s/he received; [3] if Player 2's family participated in ceremonies held in their ancestral halls, it was significantly less likely that s/he would return more than 50% of the money s/he received.

Table 5. Predicting the trustworthiness of the receiver (Player 2)

	Dependent variable: Return ratio dummy *(1=return more than 50%; 0=otherwise)*

	(1)		(2)	
Amount sent by the Player 1	0.059	(0.031)*	0.072	(0.032)**
Player 1's demographic characteristics				
Education level	0.124	(0.053)**	0.130	(0.058)**
Age (35-50 years)	-0.094	(0.397)	-0.056	(0.419)
Age (>50 years)	0.427	(0.458)	0.582	(0.479)
Male	-0.090	(0.483)	0.082	(0.502)
Player 1's social relationships				
Family head born in the village	-1.250	(0.584)**	-1.376	(0.597)**
Percentage of gift expenditure	0.013	(0.014)	0.010	(0.014)
Participation in village-wide associations (*open network*)	0.998	(0.476)**	0.899	(0.494)*
Participation in activities in the ancestral hall (*closed network*)	-1.184	(0.466)**	-1.437	(0.497)***
Interactions of closed and open networks	0.296	(0.633)	0.517	(0.663)
Surveyed trust index and other relevant indices				
Trust index		-	0.150	(0.096)
Help index		-	0.112	(0.100)
Village leader's resolution index		-	-0.689	(0.206)***
Equality index		-	0.007	(0.052)
Village- and county- level variables				
Proportions of households with telephones in the village	-2.034	(0.793)**	-1.923	(0.835)**
Jianchuan County	0.632	(0.555)	0.709	(0.576)
Jingu County	0.934	(0.621)	0.718	(0.671)
Luxi County	1.331	(0.616)**	1.429	(0.640)**
Pingbian County	-0.168	(0.693)	-0.096	(0.705)
Yongping County	0.238	(0.596)	0.541	(0.620)
Constant	0.101	(1.157)	-0.045	(1.112)
Log-likelihood	-135.915		-128.014	
Observations	226		226	

Note: Standard errors in parentheses. Both models are logit regression models. The base county is E'shan County. ***—coefficient significant at 0.01 level, **—coefficient significant at 0.05 level, *—coefficient significant at 0.1 level

The negative signs of the coefficients of variables [1] and [2] were consistent: if the family head was born in the village, the family would have high possibility of having ancestral halls established. S/he would also have more opportunities to attend the ceremonies held in these halls than by someone whose family heads were not born in the village. The different signs of the effect of family participation on Player 2's behavior in the trust game indicated the roles played by a closed and an open network.

The proportion of households with telephones was negatively significant in predicting Player 2's behaviors in both models. If Player 2 was from a village with higher proportion of households having telephones, it was significantly less likely that s/he would send back more money to Player 1 than a player coming from villages with less households having telephones. The negative sign of a telephone owner in the village indicated that people from 'closed' communities had a higher level of trustworthiness and showed reciprocal trust with each other.

The village leader's helpfulness in resolving conflicts was significant and negative in Player 2's regression model but negative and insignificant in Player 1's models. Both results may indicate a possible on-going erosion of trust and trustworthiness in ethnic minority areas because of the lackluster performance of the village leaders.

Model 2 shows that if Player 2 perceived his/her village leaders to be unable to resolve conflicts among the villagers, s/he was significantly less likely to return over 50% of the money to Player 1. This was quite unique in rural Yunnan where many ethnic minority groups lived. In many villages in the past, the ethnic group leaders used to play important coordination roles in the village, such as resolving conflicts among peer members in the village. With modernization eroding some of these ethnic cultures, some of the ethnic leaders' traditional roles have been gradually 'usurped' by government-appointed village leaders. If some elected village leaders are unhelpful in coordinating villagers' members, trust and trustworthiness among villagers would likely be eroded.

Unlike in Player 1's models, the trust index in Player 2's model (model 2 of Table 5) had positive but insignificant effect on his/her trustworthiness (reciprocity) behavior. This was consistent with the different incentives underlying Player 1's and 2's decisions. For Player 1, one major underlying incentive for him/her to decide how much money to send was his/her level of trust and perception on the trustworthiness of his fellow villagers. Therefore, trust index created based on the perceived trust and trustworthiness could play significantly positive roles in Player 1's decisions. Given the set-up of our trust game, Player 2's underlying incentive for his/her decisions mainly depended on his/her "contentiousness" and awareness of "reciprocity". Therefore, the trust index could reasonably have insignificant effects on the probabilities whether or not Player 2 would return less, assuming that the trust index was positively correlated with Player 2's decisions on the ratio of money to be returned.

Age was not significant in predicting Player 2's behavior in both models. However, older people seemed to be more trustworthy than the younger ones, while the middle-aged people seemed to be less trustworthy than the younger ones.

The percentage of gift exchange expenditure on the family's total expenditure did not significantly predict Player 2's behavior. However, it had a positive effect on the probabilities that Player 2 would return more than half of the money sent by Player 1.

As for the county dummies, Player 2 from Luxi County was significantly more likely to return over 50% of the money sent by Player 1 than players from E'shan. This implied a county-specific effect that was unobserved or unexpected.

6. Conclusion

This study investigated whether or not trust level measured by surveys could statistically predict a player's behavior in the trust game (using experimental method). Trust level was statistically significant in predicting the amount of money sent by Player 1 to Player 2 but not Player 2's return ratio. This was consistent with explanations on incentives. Trust implies Player 1's expectations on Player 2's behavior, thus his/her perceptions on the trustworthiness of peer members would have significant impact on his/her strategies taken in the trust game. On the other hand, Player 2's return ratio was derived from the incentive of mutual reciprocity, in which the players' perception on their own trust level and on the trustworthiness of their peer members often should not have significant impact.

Other noteworthy findings are as follows:

Variables related to the individual's social connections, such as gift exchanges, had more significant impact in predicting a player's behavior in the trust game than on his/her demographic characteristics.

The opposite impact of 'closed' and 'open' networks in predicting the players' behavior in the trust game has implications on social capital research. Although trust often underlies networks, different types of networks could result in very distinct levels of individual social capital, such as trust and trustworthiness for the members. Gift exchange was an important indicator of a family's social connections in the village.

The negatively significant impact of the village's openness to the market place on the behavior of both players in the trust game partially indicates that openness to the market could possibly erode bonding social capital, such as trust/trustworthiness among the village members.

The index for the village leaders' helpfulness in resolving conflicts among villagers had a negatively significant impact on Player 2's behaviors and a negative impact on Player 1's behaviors. This indicated that the elected village leaders' roles in coordination, which used to be undertaken by ethnic group leaders in many parts of China, could have critical impact on sustaining the social capital within the villages.

The positive and significant impact of Player 1's self-reported risk preference in predicting his/her behavior in the trust game indicated that his/her trusting behavior could be confounded with risk preference. Some alternative methods though could measure risk preference to consolidate this finding.

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